Perceptual and Motor Skills, 1987, 64, 968-970. © Perceptual and Motor Skills 1987

GEOPHYSICAL VARIABLES AND BEHAVIOR: XXXIX. ALTERATIONS IN IMAGININGS AND SUGGESTIBILITY DURING BRIEF MAGNETIC FIELD EXPOSURES

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Summary.—12 male and 12 female volunteers were evaluated for their suggestibility before and after an approximately 15-min. exposure to either sham, 1-Hz or 4-Hz magnetic fields that were applied across their mid-superior temporal lobes. During the field-application subjects were instructed to view a green light that was pulsating at the same frequency as the field and to imagine encountering an alien situation. Results were commensurate with the hypothesis that weak brain-frequency fields may influence certain aspects of imaginings and alter suggestibility.

This study was designed to determine if brief applications of time-varying electromagnetic fields to a focused portion of the temporal lobe region could alter hypnotic suggestibility and imagery as might be expected during experience of close encounter (1, 2). A total of 12 male and 12 female volunteers from a first-year psychology class (ages 18 to 30 yr.) were tested individually while sitting comfortably in a dimly lit room. Just rostral to the upper half of the ear were placed retractable arms, each containing a 25 cm (1 cm cross-section) soft iron nail wrapped (1050 turns) with insulated wire (20 gauge). When a function generator drove the solenoids with sine wave current at either 1 or 4 Hz, the magnetic field intensity was about 15 gauss at the surface of the skull. The field strength at the distance of the temporal cortex was 2 gauss; the maximum field strength was 200 mgauss (factor 10 decrease) at the level of the frontal lobes. At the approximate level of the hippocampus, the field strength was 500 mgauss.

The first author sat in front of the subject and evaluated him according to the Hypnotic Induction Profile (3) or HIP (0 to 10 scale), while the second sat behind the subject and monitored the subject's EKG, controlled the field and tape-recorded comments. After the first induction, the second author then gave the subject a series of instructions that involved observing a small green light 2 m away from and about 15° above the horizontal visual field. The light was flashed at the same frequency as the applied electromagnetic field. Subjects received sham field (constant light), 1-Hz or 4-Hz conditions (three groups) during the imagination phase of the experiment. Each subject was given five basic instructions that involved imagining walking through a forest, seeing a light in a clearing, perceiving the light approaching the sub-

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ject, experiencing the light enclose the subject and feeling a presence in the light. All subjects generated elaborate imaginings. Following this procedure, the field was terminated and a second induction profile was given.

Differences in heart rate and HIP scores between the first and second induction were computed. Transcripts of the imaginings were evaluated on a scale of 0 to 3 with respect to compliance (story theme in accordance with instructions), vestibular experiences, fear responses, strangeness of detail and imagery. Analyses of variance for these measures and the difference measures were completed according to field frequency and sex. Spearman correlations between HIP components and imagining scales were also completed.

Analysis indicated that subjects who had been exposed to the 4-Hz fields showed a significant decrease ($F_{2,18} = 3.73$, $p < .05$) in heart rate compared to those who had been exposed to either the 1 Hz or sham-field conditions. A significant ($p < .05$) interaction of sex by field ($F_{2,18} = 4.90$) was noted for the change in HIP scales. Whereas both men and women in the sham-field condition tended to show less induction ($\approx$ 1 unit) on the second occasion (4.5 $\pm$ 1.0), women showed much greater (8.4 $\pm$ 1.1) induction ($\approx$ 3 units) if they had been exposed to the 1-Hz field while men showed much greater (8.0 $\pm$ 1.5) induction ($\approx$ 3 units) if they had been exposed to the 4-Hz fields. On the protocols, women reported significantly more fear responses than men. In addition, subjects who were exposed during the imaginings to the 4-Hz field showed more imaginings ($F_{2,18} = 3.13$) and more references to vestibular experiences (e.g., self or entity rising or floating; $F_{2,18} = 11.50$) than those exposed to the other conditions. The means and standard deviations for the 4-Hz, 1-Hz, and sham groups for imaginings and vestibular experiences were 2.0 $\pm$ 1.1, 0.5 $\pm$ 1.0, 0.8 $\pm$ 1.1, respectively, and 2.5 $\pm$ 0.5, 1.0 $\pm$ 0.8, 1.4 $\pm$ 0.5, respectively.

Dissociation scores on the HIP were correlated significantly ($p < .05$, $df = 22$) with vestibular (0.44), imagery (0.43), and fear (—0.45) scores from the transcripts. Floating responses on the HIP were correlated with the amount of imagery (0.46). There was a significant positive Pearson correlation between the compliance measure and the amount of arm levitation during the second induction only. These results suggest that hypnotic susceptibility may be increased following magnetic-field exposure but that the effective frequency is not the same for each sex. In addition, the amount of the imagery (particular vestibular experiences) increased if the person observed a light that was flashing at the same frequency as a 4-Hz applied magnetic field. These results may be useful in considering the mechanisms of experiences of close encounter. Although the effects were quite small, the field strengths were much less than those that would be expected to occur in natural settings (1, 2).

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Accepted April 7, 1987.